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ABSTRACT

Issues and illustrative material are presented from a project evaluating modular courses at McGill University from 1972 to 1976, with the overall intent of aiding instructors to produce instructional modules. Questions related to the nature of modular instruction at McGill, how modular instruction developed, and how it operates are examined. Thirty-two findings, interpretations, and recommendations are presented in areas of course structure, management, and organization of modules and materials. General findings include: (1) Provision of study skills or guidelines is a necessary adjunct to a modular course. (2) Early support and assistance of department heads should be obtained. (3) Assembly of learning materials into modules requires adherence to a set of principles of organization. Appendices include courses evaluated at McGill, issues in innovative instruction, and a guide for using modules. (CMV)

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MODULAR INSTRUCTION:

A Resource Book

Janet Gail Donald

Centre for Learning and Development

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This book has been prepared with the intent of aiding instructors to produce instructional units commonly known as modules. An equally important purpose of the book is to explore those issues, both piquant and prickly, which arise from the use of modules. The issues and illustrative material presented here arose from a project to evaluate modular courses at McGill University from 1972 to 1976.

The project to evaluate modular courses was supported by a grant from the McGill Educational Development Committee. Thank yous are owed Seyma Faust for her research assistance and George Geis and Pat Cranton for their editorial prowess.

WHAT IS MODULAR INSTRUCTION AND HOW DID WE GET INTO THIS?

Modular instruction began at McGill when a number of faculty members felt the need to be responsive to the individual learning patterns of their students. This led them to explore possible ways of making their courses both more systematic and more flexible: systematic in the way the information was provided to students and in the way their learning was tested; flexible in that students had some choice in what, how, when, and where they would learn the course material. Aided by grants from the McGill Office of Educational Development, the professors developed a variety of approaches to the learning material in their courses, and called the packages "modules." Since 1969 over seventy modular courses have been developed at McGill. In 1971 there were 650 students enrolled in modular courses; 1976 figures approximated 6,000. During that period of time, the Centre for Learning and Development evaluated an average of twelve courses each year for a total of some fifty evaluations. The issues discussed in this resource book are based on data collected by the Centre in the evaluation project.

Modular instruction is an instructional system based on the use of planned units of instruction or modules. A module has been defined by Goldschmid & Goldschmid (1972) as "a self-contained independent unit of a planned series of learning activities designed to help the student accomplish certain well-defined objectives." The kinds of learning activity may vary but the learning outcome is specified. Russell (1974) in his guide to modular instruction focusses attention

on the module as dealing with a single conceptual unit of subject matter. The student is expected to master one unit of content before moving to another. The ideal module consists of several component parts, each with a specific instructional purpose in mind.

1. diagnostic pretest:	determines whether student has prerequisite learning experiences necessary to continue the module or whether the student has already mastered the instructional unit and can therefore proceed to another module.
2. a statement of purpose and overview of content:	act as advance organizers, that is, allow the student to conceptualize the learning to be done in the module.
3. instructional objectives:	are specific goals for the student showing what he or she will be able to do as outcomes of the instruction.
4. instructional program: composed of reading and other learning assignments	designed for active learning in which the student is given the opportunity to integrate and possibly apply his or her learning of program content.
5. evaluative post-test:	determines if the student is now competent in the area of the module and should advance to the next learning unit. If the student has not achieved competence, he or she will restudy necessary materials or use alternative learning materials until the required level of competence is met.

Why modular instruction?

The assumptions behind modular instruction are concerned with how students learn and what steps can be taken to aid this process.

1. Students do not achieve at the same rate and are not ready to learn at the same rate (Burns, 1971). Modular instruction allows the student greater leeway to proceed at his or her own rate.

2. Students solve problems and learn using different techniques based on unique behavior repertoires (Burns, 1971). Modular instruction is designed so that students have greater choice of learning mode. The variety of instructional activities may include readings; film and film-strip viewing; the use of audio- and video-tapes; demonstrations; dyadic and group work; participation in projects and experiments; and other research activities.

3. Students possess different patterns of interest and are motivated to achieve different goals (Burns, 1971). Greater choice among the variety of topics within a given course or discipline is recommended in modular instruction with the end of improving student motivation.

4. Students will learn better (more efficiently) if their strengths and weaknesses in the subject matter are identified early (Goldschmid & Goldschmid, 1972). If the student receives feedback about how well he or she is doing early in the learning experience, the student will be better able to profit from the instructional experience.

One of the exciting aspects of modular instruction is that it suggests new and more active roles for both students and instructors. Each student must make more decisions about what, when, and how to learn from among the increased number of alternatives. Students do receive guidance in their learning, however, through the module objectives, organized instructional materials, and the availability of the course instructor or teaching aide. The evaluation of learning is more frequent and associated more closely with students' actual learning activities. Course grades reflect what the student has learned according to the course goals rather than in reference to his or her peers, and are therefore a more stable and accurate measure of the learning that has occurred.

The instructor's role also changes in modular instruction. Because learning materials have been prepared prior to the giving of the course, the instructor becomes a diagnostician and resource person. More time is available to deal with individual students' questions and learning problems. The instructor also has the challenge and the opportunity of "going beyond the information given" by means of enrichment lectures and project advising.

And now a confession:

Very few of the courses at McGill meet the ideal description consisting of the five component parts of a module. As each modular course was developed with a specific subject matter, student population, and departmental administration in mind, pretests and post-tests, overviews and objectives, were at times left behind in the dust. Some modular authors integrated the best methods of individualizing instruction, that is, responding to individual differences among students; others focussed on the idea of a module as a conceptual unit of subject matter. The term "modularized instruction," then, must be understood to include, at least in this text, a broad spectrum of learning systems.

Degrees of modular instruction

Probably the most noticeable way in which modular courses varied was in how much use of modules was made in the course. Some courses were wholly composed of modules, others were partly modularized, and in a third group of courses, modules served an auxiliary or supplementary function. Where courses were wholly modularized, some followed a compulsory

lock-step pattern, while others allowed total flexibility in student selection. Partly modularized courses appeared where course objectives included both conceptual learning, which was organized in instructional units, and group application or participation. Courses in social psychology or orchestral production would be likely candidates for this format. Supplementary, or auxiliary modules were created for purposes of remediation, enrichment, or variety. Where a general topic, such as elementary statistics or information retrieval, was included in a course, very often the instructor would create an independent module to be used at some point in the course as a variation in teaching methd. Goldschmid and Goldschmid (1972) and Shore (1974) have discussed these different formats in greater detail.

To the would-be developer of modular instruction, we can offer a few guidelines for determining which format to use. For McGill modular authors, the choice of format depended upon, in descending order of importance:

(a) the instructor's perspective on and objectives in teaching,

(b) the instructor's time available to plan, develop, and test modules,

(c) the number of student-users of the modules,

(d) administrative and monetary support available for the production and operation of modular systems; and

(e) the nature of the subject matter area.

The instructor opting to modularize a whole course requires a sizeable amount of time to develop the series of modules. The estimated time to develop one module is a minimum of three months of full-time work to plan, produce, field test, and modify. The early modules always take longer. The most plausible strategy for the new developer would be to design and

develop an independent module to test the feasibility of further module use in his or her course. Instructors who have developed modular instruction often move from one format to another, some starting with independent or part-course module use, then moving to a greater use of modules. Others develop a whole-course format, then revise some of these modules to fit a supplementary role. The evaluation of a modular course frequently led to adjustments in format to better fit the instructor's and students' needs.

But what does it cost?

We can assume that in this era of accountability and restricted budgets, a university would not willingly increase expenditures for changes in teaching method. The university does, however, have the responsibility of ensuring that its teaching resources are used in the most efficient and effective manner. By "efficient" we mean lower cost per student; we measure the "effectiveness" of instruction in terms of the number of students achieving an acceptable learning standard, such as an overall eighty per cent in a course. The operating costs of modular instruction have not yet been determined to be greater or less than the costs of ordinary instruction. Here are some factors however, which will increase or decrease the cost of modular instruction.

1. Space. The amount and kind of space varies depending upon the format of the individual modular course. Classroom space may be saved in favor of library or audio-visual room space. A course center may be required, although the professor's office or an available area in the department may serve this purpose. Because modular courses are individualized

smaller areas may be able to meet the needs of larger numbers of students, but the learning center or area may be required over a greater period of time.

2. Students. An increased number of students can use modular instruction, which means greater efficiency. Greatest operating savings could be expected to occur in larger courses, or courses where the size is increasing. The use of independent modules in a number of courses and the sharing of units in similar courses would also lead to greater efficiency.

3. Teaching Staff. Modular instruction has led to the use of differentiated staffing. In contrast to the conventional lecture or seminar course in which each professor meets with a class of a given size, in modular instruction the professors in a given subject matter area can assume a variety of functions, some continuing as module authors, others acting as discussion leaders or consultants or course evaluators. Modular instruction has also allowed the introduction of teaching assistants, most often graduate students, who act as conference leaders, take charge of learning centers, and aid the professor in course management. Modularizing a course may result in a great saving of time to the professor, but an equally possible outcome is that the professor will now spend time in individual or small group conferences, in the revision and updating of modular materials, and in enrichment functions in the course. In summary, the professor is more likely to change the nature of the time spent on the course than the amount of time spent.

4. Developmental costs. The major cost in modular instruction is for the development of the modules, including their design, production,

implementation and evaluation. The investment for the development of a course which is wholly modularized has ranged from $8,000 to $21,000 (McGill Office of Educational Development, 1976). A comparative figure from the Open University would show that developmental costs for a course in which an instructional design team of fifteen people works over a period of two years can range to as high as $1,250,000 . These costs can include the time and/or salaries of module authors, of design and evaluation consultants, of research assistants, technicians, and secretarial aid, and of student "try-out" subjects who would test early versions of the modules. In addition, there are costs for materials required for modules such as audio-visual equipment and reprints as well as production and supply costs. Space, maintenance, and the continued costs of revisions and updating are also included in any developmental budget.

In short, capital or developmental costs will be increased, but a reallocation of university resources to fit the operating needs of modular courses would not be expected to increase costs. Modular course development would have to be considered as an investment.

How the modular courses were evaluated

Although the Centre for Learning and Development had been active in the approval and planning of modular development projects, our principal contribution to modular instruction was in the evaluation of the modular courses. Appendix A of this resource book lists the professors and courses which were evaluated during the four years of the project. Our primary aim in the evaluations was to aid instructors in implementing modular instruction and evaluating the outcomes of it. Instructors were provided with

formative data to assist them in developing or revising their methods of course operation and evaluation of learning. Because each course had been designed with a specific student population in mind, each evaluation was individualized according to the subject matter area, the student population, and the specific needs of the instructor.

Three principles guided the evaluation. First, as suggested by Cronbach (1963), we used systematic observation to establish the modus operandi of the course, particularly student interaction with instructors, teaching assistants, and learning materials.

Second, we wanted to verify the effectiveness of the learning materials and system. Although it was difficult to obtain proficiency measures during the course, data was collected on the success of students on individual modules, and where courses were evaluated over more than one term, some comparative data could be collected. Attitudes toward different aspects of the course were measured through interviews and individually designed course questionnaires, not only to obtain indices of student satisfaction but also to determine the effect of the course on students' decisions about the kinds of courses they would take in the future.

The final guiding principle was that the evaluations should be responsive to the instructor's requirements for information and in doing so, should take into account the course and instructor's perspective. The process of responsive evaluation is one of continual observation and negotiation, of communication rather than judgement (Stake, 1975).

Fitting these principles to our task, we developed a cooperative team model in which the modular instruction professor, the project

coordinator, a consultant from the Centre professional staff, and an observer-evaluator who was a student at the University worked together to understand the important issues and questions concerning the course, to gather data about the course, and to discuss the results which would lead to course development and improvement.

Evaluation team members

1. The project coordinator served as liaison for all team members, as well as providing advice and supervision to the evaluators.

2. A consultant from the Centre provided professional expertise and resources throughout the evaluation.

3. The observer-evaluator provided feedback to the instructor from the students. The job included the observation of the learning process, interviewing students, compiling evaluation questionnaires, and reporting results of these procedures. In order to do this, the evaluator attended workshops which focussed on specific evaluation skills such as basic techniques for data collection and interpretation, and report writing.

4. The instructor who wanted his or her course evaluated brought to the team those questions and concerns about which he or she wanted advice and feedback. Often they centered around problems of course structure and on the organization of the modules, however a wide range of issues was present as will be seen.

The evaluation process

Course evaluations took place over a term or an academic year. A summarized review of the process is presented here but a more detailed plan of the process can be found in the Report on the Evaluation of Modular Instruction (Donald, 1976).

A.	problem explication:	a planning meeting to determine relevant issues to be investigated, areas to be focussed upon, and the steps and schedule of the evaluation.
B.	information gathering:	by means of class or learning centre observation; student interviews, questionnaires and test results.
C.	reporting:	the team members reported relevant findings to each other during the process of the evaluation. A final report describing the findings was prepared and discussed at a final team meeting and recommendations and plans for revisions were made.

The evaluation of the modular courses provided us with formative data for each of the individual courses involved, but in addition, it gave us the opportunity to reflect and generalize about modular instruction in operation. The findings and interpretations follow.

FINDINGS AND INTERPRETATIONS

The introduction of modular instruction created a window for looking at the learning process in higher education. As we evaluated courses, we came upon questions of adaptation between students and courses, between professors and their courses, and between the courses and administrative procedures at the university. And although some of these questions could be applied to any course, they were highlighted in modular courses which had, after all, been created with the aim of improving instruction. The questions fell into three categories (see Appendix B). How the course was organized or structured in terms of course requirements, contact between student and professor, and arrangements for pacing, workload and evaluation seemed to cause the greatest number of questions of adaptation. A smaller, but in the early days of modular instruction, more critical area of questions was that of the management of courses. Finally the organization of the modules themselves turned up a large number of questions.

Over the four years in which modular courses were evaluated, we noted a change in the kinds of questions which arose. One of the most severe problems in the first year of operation was that of management: organizing materials, schedules, and facilities caused the largest headaches. In the later years of the evaluation project, however, these kinds of problems appear to have been foreseen and prevented by the time the course was evaluated, and professors and their students were more interested in questions

about learning per se in the course. For example, issues such as the integration of course material or the effect of different optional steps which students could choose were focal.

As a preliminary step in this analysis, we tallied the frequency of occurrence of each of the questions which arose in the courses evaluated. Of 148 questions found, the majority (53%) were questions about course structure. Seventeen per cent were management questions, and the remaining thirty per cent were questions about how the modules were organized. (see Figure 1).

In all, we discriminated fourteen areas of questions under the three main headings of course structure, management, and the organization of modules. Let me introduce them.

Course Structure: how the course is organized. The amount of structure is determined by the number of explicit requirements within a set of learning alternatives. The pattern of the learning system and its efficiency and effectiveness are at issue here.

A. Course Requirements: includes mandatory or optional requirements, their clarity of presentation, and issues to do with student background.

B. Availability of Materials: whether modules, other course materials, and reference books are accessible.

C. Contact: opportunity for interaction between student and instructor and among students.

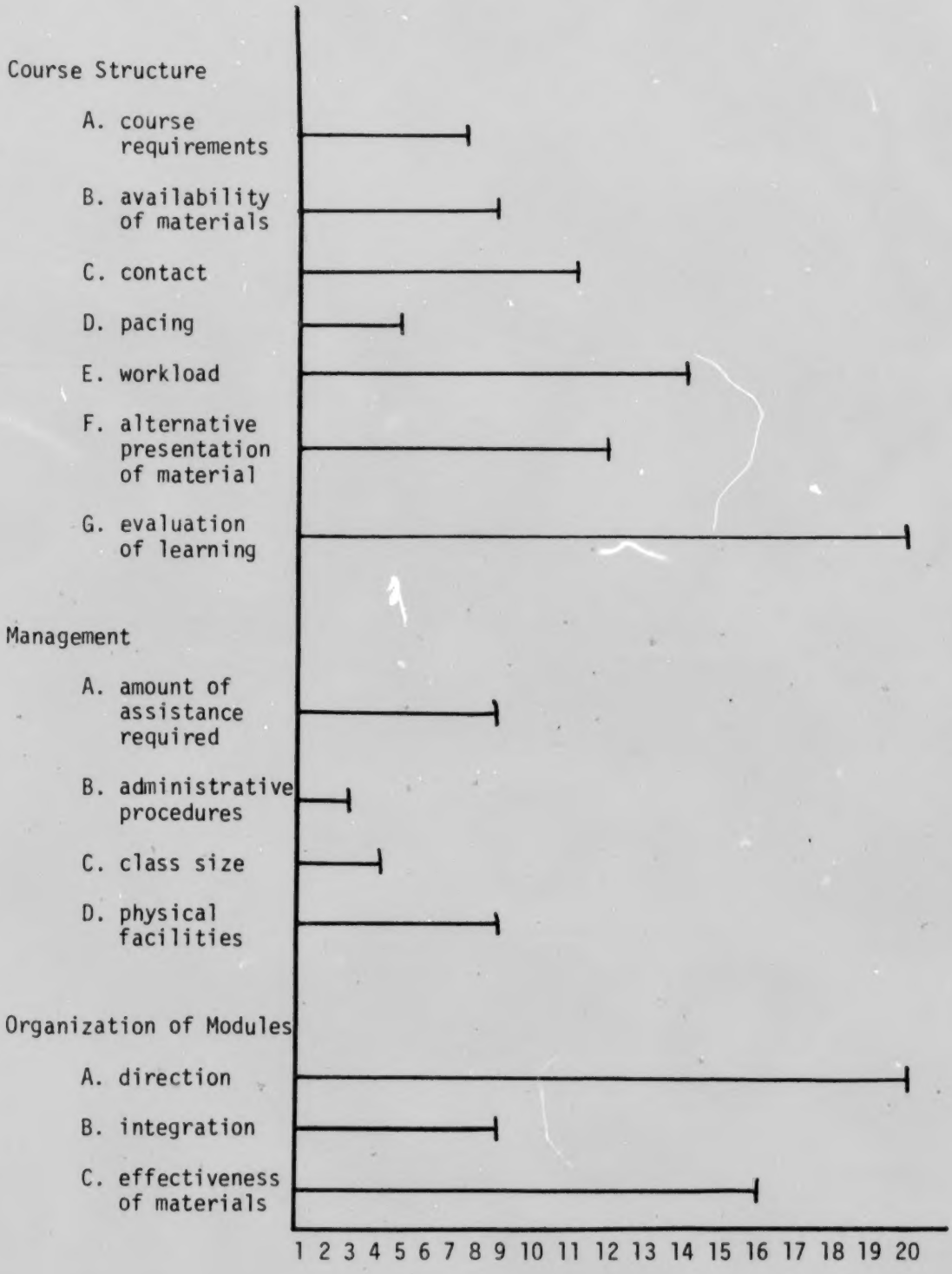

Figure 1. Frequency of occurrence of modular instruction questions

D. Pacing: the effect of self-pacing on learning effectiveness and degrees of self-pacing.

E. Workload: concerns what is essential material and the length and difficulty of modules.

F. Alternative Presentation of Material: modular courses vary in information presentation methods using assigned readings, audiovisual aids, projects, conferences, and lectures in novel forms.

G. Evaluation of Learning: feedback is an important issue and testing and grading procedures are different.

Management: course management adaptations are essential for the effective operation of a modular course. These adaptations may require new administrative procedures as well as different physical facilities.

A. Amount of Assistance Required: resources, time, and teaching assistants are new facets to be dealt with.

B. Administrative Procedures: stresses the need for greater advance planning and follow-through, and deals with potential changes in grading policy.

C. Class Size: is there an optimal class size for modular courses?

D. Physical Facilities: different spaces and times and how the university can accommodate.

Organization of Modules: principles and possibilities for making modules more effective.

A. Direction: how much is needed and how to provide it.

B. Integration: important for learning retention, how do we provide for it among modules and within modules?

C. Effectiveness of Materials: student achievement and student satisfaction with modular materials and the effectiveness of materials with different students are important issues here.

And now, after a brief introduction to the questions and issues we found, we take a look at issues in greater depth. Our conclusions in response to the issues are asterisked for easy reference.

Course Structure

How the course is organized, both in the number of requirements set and the overall learning pattern, will have a major effect on course effectiveness and efficiency.

Because modular instruction entails a variety of course structures different from conventional instruction, the accepted rules of learning in higher education, such as term papers and examinations being the course requirements, attendance at class being considered equivalent to "taking a course" and normative grading practices are called into question. Students in modular courses must first find out what rules are different, then adjust to them. The rules may in some cases give students a more precise idea of the expectations of the instructor. More often, however, students have been given responsibility for their learning, without suggested guidelines of how to approach their studies. Franklin (1976) found that the most important factor in achievement in an individualized course was good study habits. These were found to be more important than intelligence in achieving success in an individualized course. Franklin suggests that the essential skills in an individualized course are different from those traditionally related to academic success in more conventional courses. It follows that the provision of study skills or
* guidelines is a necessary part of the structure of a modular course.

A. Course Requirements

Mandatory or Optional. The first major question that arose in the area of course requirements is "what part of the course is mandatory, and what part is optional?" Although this question refers primarily to course content, it can also be asked meaningfully of the learning experiences in the course. Most modular courses offer a variety of options both in content and in the fulfillment of requirements. In most courses, certain modules are mandatory and the remainder are optional. For example, students might be required to complete modules A, B, C, and any three of D, E, F, G, or H. Completion of additional modules might then count as extra credit. An important caution must be introduced here. In one of the early course evaluations, it was found that students were able to earn a passing grade by completing a minimum number of modules. A large proportion of students opted for the minimum grade, suggesting that modular courses offer an additional option of "to learn or not to learn."

The use of optional modules introduces an additional demand on the module author. Unless optional modules are designed to be equivalent in length and difficulty, students will not choose modules on the basis of their interest or content preference. In modular courses at McGill where some modules were found to be more difficult or longer than others, students unknowingly choosing these modules later considered themselves to be penalized, and as soon as the difference among modules was known to the students, they tended to avoid more difficult modules. As a result, some modules were not used at all.

* It is therefore suggested that modules be weighted according to difficulty and that a policy of equal work for equal grades be adhered to.

Clarity of requirements. A major concern to students is that learning experiences and required skills be set out clearly. In the eight courses in which course requirements were an issue, the most frequent request was for a clearer exposition of what was to be learned. A study guide or set of instructional objectives would serve this purpose. Stating objectives also aids the instructor to sequence instruction, allot time to topics, assemble materials, prepare outlines, and present information (Geis, 1972). When course objectives were clearly presented to the students, their satisfaction with the course increased substantially.

Student background. Clarifying the requirements for a modular course led many instructors to consider individual differences among their students. Where there was marked variation in the aptitude and entering knowledge of students, course requirements had to be adapted to both challenge and interest the students. One example was a course that was required for first year students specializing in the subject area but open to higher level (second and third year) students who would not be specializing in that field. Options which allowed the specialists to learn in detail, and others which allowed for input from other disciplines, were created to meet student needs.

Several methods for determining student background were employed in evaluations so that instructors could adapt their courses to individual needs. The methods included: obtaining students' own conceptions of their background in the subject

area; asking students to define or apply key concepts which they were required to know on entry to the course, what related experiences they had or books they had read in the subject area, and what their goals in the course were. Using information gleaned by these methods, professors were able to develop remedial and enrichment tracks in the learning system, and to provide review or supplementary classes to enable more students to meet the course requirements.

Contracting. In some courses the question of course requirements was resolved by contracting for learning. A learning contract is a document, drawn up by a student and his or her instructor which specifies what the student will learn, how this will be accomplished, and within what period of time, and what the criteria of evaluation will be (Donald, 1976). As a minimum, in a modular course, contracts specified which modules would be attempted, what learning methods would be used, and what evaluation procedure would be followed. Several courses used a procedure in which course requirements were set out with reference to different grades. In contracting for grades, the modular student could, for example, elect to master 10 modules for an "A" grade, 8 for a "B" grade, for 6 for a "C" grade. A disadvantage with a student new to modulal instruction is that the student may elect to master more modules than is feasible. Escape clauses which allow students to adjust their horizons part-way through the term have been found to be necessary for a percentage of the students, primarily because of the

workload and mastery requirements of modules.

* The general finding in the investigation of the effect of course requirements was that where they were clearly and fairly stated, and where they were responsive to student background, there was greater satisfaction in the course.

B. Availability of Materials

The availability of materials was a major issue in nine of the courses evaluated. One of the advantages of modular instruction is that the instructor usually develops a module booklet to correspond to each unit of the course. The module booklet may contain a collection of readings from various sources or may cite relevant paragraphs or references. The student is saved the time and effort of carrying out extensive library searches. Copies of module booklets are put on reserve in the library and can be purchased in the university bookstore for those students who wish to have their own copy. Pretests and instructional objectives are also included in the module booklet. If audiovisual material is part of the requirements of the course, the professor will sometimes insert a brief introduction to it in the module booklet as well. It would be expected, then, that materials more specifically related to the course would be more readily available for students following a modular course. Although this is so after a modular course has been in operation for two or three years, the availability of the modules themselves has been a source of problems in the first year or so.

Management of materials. The problem with many modular courses in their first year of operation was that a sufficient

supply of all required modules was not available at the start of the course. In several courses, this led to further management problems, causing the students to develop a negative attitude to the modular system. Students expressed a strong preference for having all the modules available to them at the outset so that they had an overview of the course. In instances where the modules were still in the process of being developed, the student's choice of options was limited. In several cases, diligent students voiced frustration when they could not proceed with the course due to the unavailability of the modules.

* It is recommended that the instructor allow a great deal of lead time from production to use of modules. Furthermore, the instructor should consider one unit at a time. Very often, instructors who have not completed modular units for an entire course will offer the remainder of the course in a conventional format. Thus in the early stages of the development the course may be only partially modular. We therefore recommend that a
* modular course be planned taking into account the large amount of time required to develop any one module, and that the developing instructor begin by modularizing two or three units of instruction only during the first year. It should be noted that the time required to develop a unit of modular instruction will more closely approximate the time required to develop forms of programmed instruction, for example, on television or computer, than a chapter of a book. Time estimates for the design, production, testing, and preliminary revision of one unit run from a minimum of one month full time to a maximum of six.

Reference books and reading material. Where reference books for assigned or supplementary reading, as well as audio-visual aids were not readily accessible to the student, they were not used. Where students were sharing materials, a major request was that a fair and reasonable management system be instituted. One suggestion was that copies of the reading materials be made available in the Drop-In Centre under the supervision of a teaching assistant. A further concern of students was that the cost of the learning materials be reasonable. Students often expressed dissatisfaction with a two hour reserve book policy and stated a preference for being able to take modules for 24 hours or longer. In addition to the usual end-of-term rush for materials, students complained about equipment (such as carrels and tapes) not functioning well. The problem was not always with the equipment itself, but with the student's lack of
* experience in using it. Aid could be given in an instructional unit or note on how to operate the equipment.

C. Contact

The question of sufficient opportunity for students to contact the instructor, teaching assistants, or other students in the course arose in eleven of the evaluations. Although this is a general complaint in higher education, and students remark that they feel a loss of identity within an impersonal university system, there are particular aspects of this problem related to modular instruction systems. If the student in a modular course does not have to contend with being one of one thousand in a popular lecture course, he or she must have some means out of the potential isolation characteristic of individualized instruction.

Student-instructor contact. Students often expressed the need to know who was in charge of their course. Responses to this request included meeting the instructor at the start of the course, particularly in an interview or small group session, so that students could more easily approach the instructor on an individual basis when the need arose later on in the term. Where the course consisted of learning materials alone and there were no class sessions, students voiced the feeling that the instructor was not putting enough effort into the course. Some students went as far as to say that they did not pay tuition fees to work on their own. Students appear to have a real need for continued contact of some kind with the instructor.

This contact may be in the form of conferences, seminars, or occasional enrichment lectures, but to be successful, these meetings must be responsive to student needs. For example, in

one course, unstructured class meetings were held once weekly to give students the opportunity to ask questions or discuss relevant issues. Although attendance was high during the first weeks, it began to drop off later in the term. As soon as course evaluation results were available to pinpoint problem areas in the course, the instructor prepared presentations on topics in the problem areas. Attendance for these meetings remained high throughout the term.

In some courses, students stated a preference for discussion meetings, while in others, students asked for more review and explanation of course material. The nature of the contact in any course would depend upon the kind of subject matter, the difficulty of modules, and the ability and study skills of the students. A beginning-of-term survey of students' background in the course, their expectations, and preferences in the form of contact to be used in the course would provide the necessary information for the instructor who introduces modules and is seeking the optimal form of contact.

Communication among students. Corollary to student need for contact is the need for a system of communication in the course. Notice-boards, study guides, or periodic news bulletins have been used to inform students of tests, seminars, conferences, special lectures, and other activities. Teaching assistants leading regular conferences or tutorials with students were often found to be the best means of ensuring communication. Students then had the opportunity to meet other students in the course and

to exchange experiences and findings, and to take seriously the responsibility of attending and participating. Where the modular course size exceeded one hundred, it was found necessary to use scheduled conferences rather than a drop-in centre so that instructors and teaching assistants could use their time efficiently and effectively. Scheduling prevented mobs and pre-examination jam-ups which otherwise would occur. In any course, the student has the right to some form of contact with course instructors and other resource persons: finding the optimal mode for contact should be a high priority for the instructor.

D. Pacing

Modularized courses at McGill were defined as "self-paced" and in the early years of the evaluation project, problems arising from self-pacing were considered a necessary cost of the system. It became evident, however, that this aspect of modular instruction was endangering the effectiveness of the instructional method for a certain percentage of students, and that something had to be done.

Self-pacing and learning effectiveness. There is some evidence that overall, the greater the degree of self-pacing allowed in a course, the more effective learning takes place (Geis, 1976). Studies of programmed instruction have shown that the grade distribution is skewed at the upper end when self-pacing is allowed. This suggests that more students learn more under this system than in a conventionally paced course. Jamison et al

(1974) point out that students overall tend to learn faster with programmed instruction: students get the same results in less time.

When time spent in instruction in a self-paced individualized course is examined, however, time varies inversely with achievement (Franklin, 1976). Franklin's study suggests that traditionally good students who would be expected to thrive in self-paced instruction, spend longer completing the course than students who received the best grades. Thus, self-pacing has differential effects on the student body.

Self-pacing could therefore be expected to be effective for those students with the necessary ability, study skills, and personality. For all the others, though, some pacing guidelines are needed for efficient use of the learning resources. While the self-pacing aspect of modular instruction was one of the attributes enjoyed most by many students, others expressed difficulty in planning their study time and found themselves with a backlog of assignments toward the end of term. This in turn created problems for the teaching staff as it led to a last-minute pile-up of students with questions and papers to be graded.

Degrees of self-pacing. To consider the effect of self-pacing, let us look at the two ends of the self-pacing continuum. In instances where instruction involves a minimum of self-pacing, one could be expected to find a class for which reading was required and was tested at each class meeting. In instances of maximum self-pacing, the student would be expected to take an examination or present a report when he or she was ready. Graduate

comprehensive examinations and theses are of this nature. What is at question at the undergraduate level, where most modular instruction takes place, is the responsibility the university has vis-a-vis the student for learning efficiency. Self-pacing at the undergraduate level appears to leave learning at prey to the study skills and personality of the students. At the same time, one of the broad aims of modular instruction is to enable students to develop an ability to plan and manage their studies and assume a sense of responsibility for their progress in the course. The diligent or competent student is given the advantage of being able to complete the course ahead of time. The less conscientious student is in trouble.

Solutions to the problem at McGill have been to limit the degree of self-pacing or to provide extra guidance to the student entering into modular instruction. The "limits" approach allows the student to self-pace but warns him or her of the expected time required to do each module, the expected completion dates of modules, and deadlines for assignments. Since a course tends to run for a limited period of thirteen or twenty-six weeks, and students must meet those dealines in any case, the assignment of certain periodic deadlines still leaves relative space to self-pace. This approach is perhaps more responsible than that of the term paper and examination requirement which allows the student to cram at the end of the term, and it is at the same time less restrictive than a daily attendance or weekly test requirement.

Another approach has been to provide students with self-study skills. For example, an orientation module outlining self-

study skills and how modular instruction operates is being developed as a CLD teaching and learning module. A one-page guide for using modules which covers aspects of planning, pacing, and contact has been developed for use in one modular course (see Appendix C). In other modular courses, the instructor and teaching assistants have provided personal guidance to students on the topics of study skills and time management.

E. Student Workload

Problems of student workload occurred in fourteen of the courses evaluated, making it the fourth most frequent problem. Workload refers to the amount of work that the student must do in order to meet the course requirements. This issue arises in almost every course, conventional or modular, however, in modular instruction problems of workload appear to be more noticeable.

Essential material. The main problem concerning the heavy workload appears to stem from students' perception that all material in a module is essential and that they must treat the information in a module as they would their own notes rather than as a textbook which is expected to contain a certain proportion of redundant or optional material. If the instructor has prepared the modules in note or essential fashion, it could be expected that students would have few problems, but a common complaint from students was that module booklets and assigned readings often contained irrelevant information causing them to spend many unnecessary hours of work on which they were not evaluated. Content

* overviews, pretests, and instructional objectives can be used to overcome this problem (see pp. 47-51).

Length and difficulty of the modules. The second source of workload problems was in the actual length and difficulty of the modules. In a course consisting solely of modules, for example, one in which the requirement was the completion of nine modules over twelve weeks for three credits, each module could be expected to require an average of fifteen hours work (at 45 hrs. work per credit). Many students at McGill found the workload in modular courses heavier than in conventional courses. This was in part due to the problem of instructors' inability to estimate the amount of time required to complete a module.

* To alleviate this problem, it is recommended that an essential step in the development of modules be a preliminary field test on a small group of students. Such a field test would allow for content problems, sequencing, workload, and many other problems to be seen and corrected. This should occur well before students in general are expected to use the modules and be evaluated on their learning. This developmental step may appear onerous at first glance, but the investment is small compared to the potential saving. Often excessive workloads in modular courses have led students to avoid audiovisual aids, optional learning assignments, and extra-credit modules which have cost far more to produce than field-testing would cost.

F. Alternative Presentation of Material

Alternative presentation of material refers to the different methods of presentation of material which may be used in a module. A module may include a combination of the following teaching media and methods:

(a) assigned reading from textbooks, articles, or library materials;

(b) audiovisual aids including tapes, slides, films;

(c) projects, surveys, experiments, field trips, workshops, laboratories, or simulations;

(d) conferences, seminars, or tutorials;

(e) supplementary or enrichment lectures.

The choice of medium for presentation of material depends on the instructor's conceptualization of how particular students can best learn certain material and the kind of learning that is expected of them. Matching method to learning objective requires intensive consideration of these factors. The difficulty for the module developer is to achieve a balance between interest due to variety and confusion due to changes in style. The alternative presentation of material was the fifth most common issue: in twelve of the courses evaluated, concerns with particular teaching methods or with the synchronization and relationship of different methods were found. Student choice of learning method, although it led to greater satisfaction for some, created confusion for others.

(a) Assigned reading. One outcome of modular instruction is that essential information in the course is readily available to each student. Problems are exacerbated when students are directed in their modules to reading materials that are not readily available. There is an expectation that learning materials be available at the time needed and in sufficient quantity. Most students, we have found, prefer to have their own copies of reading material. Where this has proved impossible, arrangements to have several copies reserved in reading areas have proved helpful. For some modules which required research assignments, it was found necessary to provide students with explicit "how-to" information in the modules, and to pre-arrange research assistance from the library which housed the information before students were able to cope with the assignment. For required reading outside the modules, a rule-of-thumb is one copy per six students.

(b) Audiovisual aids. Audiovisual instruction has become particularly popular among professors, more so than among students. As one of the first versions of individualized instruction was Postlethwait's audio-tutorial method (1970), often instructors who consider modularizing a course think first of audiovisual aids. If the audiovisual material is chosen with discrimination and used appropriately, it enhances the learning situation. If not, students report boredom and tend to avoid viewing the audiovisual material. The material must be essential, well coordinated, and easily reached for ready use by students.

Arrangements for viewing the material need to be made well in advance and it is imperative that all components of the equipment, from videotapes to slide projectors, be field tested before they are put into use.

(c) Projects et al. Long-term assignments, surveys, and field work fit easily into modularized instruction because of the greater flexibility in course arrangements. Although a form of contract may be required to guide the student's work, few problems have been encountered in the organization of projects per se. When students have been allowed options among projects and modules, however, it has been found that the students divide into two distinct groups. More advanced students tend to choose projects while the less knowledgeable, independent, or motivated students prefer modules. Although this could be regarded as an advantage of alternative forms of presentation of materials, in that different students' needs and levels are being considered, instructors should be cautioned to not deliberately create two classes of students or two standards of excellence by this means.

Workshops, laboratories, or simulations can add variety to a course but require an additional chore of scheduling. Where these learning methods have been used interactively with modules, so that information or individual problem-solving derived from modules can be applied in an experimental setting, the effect has been positive. Developing additional laboratory or game simulations has required a great deal of effort and ingenuity on the part of the instructor, but has proved a worthwhile

experience. To aid in scheduling such experiences, sign-up lists or pre-arranged meeting times for small groups can be used.

(d) Conferences, seminars, or tutorials. These are small group meetings in which material is discussed and students are given an opportunity to interact. Although all three terms are used interchangeably, a distinction can be drawn among them. A seminar is a method of group discussion focused on a piece of work on a particular topic which has been prepared and orally presented by one of its members. A conference is usually used for purposes of review or remedial work and usually in conjunction with other methods where material is initially presented. In a tutorial, no more than four students meet regularly with an instructor to fulfill a program of study. The method employed most often in conjunction with modular courses at McGill was the conference.

Often under the aegis of a graduate teaching assistant, it * is recommended that conferences that accompany modular courses be devoted to promote discussion among students rather than to simply serve as a review of the material. "The essential idea is to maintain a sense of intimacy and a spirit of lively debate," (Edwards, 1971). In some instances, students have suggested that they would like to receive credit for participating in a conference. Evaluation could take the form of written work or oral presentations. Conferences provide an excellent opportunity to cover topics relevant to a particular group. They also provide an

orienting function for project or field work so that students have an opportunity to discuss and consolidate their learning.

The limiting case of a conference, the learning cell, or dyad (Goldschmid, 1971) has proved successful as an intermediate evaluation or learning step in modular instruction. Students sign up to meet another student who has been working on the same module and they test each other's knowledge at a check-point in the module or before a more formal evaluation. The use of dyads, also known as peer teaching, has proved to be of great value as a teaching method in courses where the guiding philosophy is one of cooperative learning.

(e) Supplementary or enrichment lectures. Lectures, or assigned class meetings, serve a variety of purposes. They may be used as a point of contact, or for the presentation of information that is not included in the module booklets but is a required part of the course. Supplementary lectures have been used for the explanation of certain concepts in the module booklets or as remedial sessions for those students who do not have an adequate background in the subject matter. Supplementary lecture hours, because they are scheduled, have also been used for game simulation activities or guest speakers. Very often, students in modular courses express a desire to have supplementary lectures as they feel that it helps them to recognize important facts to be learned and to group the information better.

If lectures are an integral part of the course, the instructor should ensure that there is not too much overlap between module readings and lectures. Where this has occurred, it has resulted

in students relying on either modules or lectures and thereby missing important information presented in the unused mode. Lectures should serve to provide the student with direction in the course, should clarify the material presented in the modules, and should integrate information from the various sources used.

Whatever methods of presentation are used, they should add to the learning experience, rather than competing with each other. The best way to determine which form of presentation to use with which material and learner population, is to conduct a series of field tests with most likely forms and to compare the results over a period of time. It has taken some instructors three years of experimentation to find the optimal form or forms of presentation.

G. Evaluation of Learning

This second most prominent issue was found in twenty of the courses evaluated. Most the problems revolved around student need for feedback early in the course, the question of testing what is taught, and grading procedures in different courses.

Feedback. Students in conventional courses gain a sense of security about how much they are learning simply by attending lectures. Without a class meeting to act as a gauge of the amount learned, as occurs in many modular courses, students voice insecurity about their progress. Whether students have or have not learned from the lecture may be debatable, but their need for reassurance that they are indeed learning in a modular course is very real. Students very early in a modular course request

feedback on their performance. More important, however, is that feedback on their performance up to a certain point in the course provides them with the direction and motivation to proceed with the remainder of the course. Very often a student does not realize that he or she has been approaching the subject matter in a less than effective manner until feedback from the first assignment is given. Periodic tests and assignments also provide the student with direction in pacing his or her learning.

Prompt feedback is important to the instructor so that learning difficulties can be caught and remediated early. If we allow that instruction is a form of interaction rather than one of indoctrination, the instructor has the responsibility to ensure that as much interactive feedback as possible occurs in his or her course. Where the evaluation of success on the modular units consists of post test results, it is important that turn-around time on test results be minimal. The greatest anxiety expressed by students generally was that feedback was so slow that they had no idea where they stood in the course until very late in the semester.

Testing what is taught. In modular courses students learn of the importance of particular topics or material through the module overview or objectives. It is equally important, if grading is going to be fair, for evaluation to reflect course objectives. A common plaint of students has been that they are not adequately informed about what they are responsible for. Very often they have spent many hours studying side issues rather

than essential material.

In addition, students have frequently remarked in course evaluations that testing procedures did not adequately reflect their knowledge of the material. This is especially true for large classes where the evaluation format is a multiple choice examination. Students generally prefer to have a short answer or essay option in addition to allow them to express themselves. Test construction requires considerable expertise tied in to course planning and development, in modular courses as in any other kind of course. A guide to the evaluation of learning and a newsletter on that topic have been prepared by the Centre for Learning and Development to aid instructors in the choice and development of appropriate tests (Donald, 1976).

A computerized system of testing is currently being used by some modular courses. This form of testing is particularly useful for self-paced modular courses. When a student is ready to take an examination on a particular unit of the course, the computer terminal can readily provide the test, score it, provide feedback to the student, and record the results for use by the instructor.

Grading procedures. Justice in grading requires that the rules of the game be set out at the beginning of the course and then adhered to. It also requires that equal grades for equal work (to an equal standard) be given. An important application of this guideline is that modules be of similar length and difficulty if students receive the same grade for completing them. If modules differ in length and difficulty, grading

decisions or weighting should take this into account and this information should be made available to all students.

Modularized instruction provides the instructor with an opportunity to apply a mastery learning system of evaluation. Some modular courses at McGill operate on the mastery system in which students must be able to master a module before proceeding to the next one. Mastery, or competence, is measured by the student's achieving 90% or more on a unit test. Under such learning conditions students may spend as much time as needed on the module and they may repeat tests as often as the instructor can or will provide them. Students may or may not be penalized for repeating a test.

As mentioned in the section on contracting, grades can be contracted for according to the number of modules completed (p. 20). The student then has a choice of completing a certain number of modules according to the grade desired. Evaluation by the mastery system ensures that grades reflect the amount learned but that what is learned is learned to a standard of high quality.

Management

Management issues were concerned with the different administrative procedures and interfaces with the operating support system, such as available physical facilities, of the university due to modular instruction. Although overall these issues did not occur as often as those of course structure or the organization of the modules themselves, they did occur in the early years of the instructional innovation and are therefore of greater importance to anyone beginning a system of modular instruction. Major differences requiring administrative adjustment occurred in the area of human and physical resources. This was reflected by the number of problems expressed under the headings "amount of assistance required" and "physical facilities." Nine courses reported problems in each of these areas. Class size also caused a few headaches as did administrative procedures.

The resolution of management problems often lies outside the instructor's domain, and the early assistance of department heads and physical resource directors is recommended.

A. Amount of Assistance Required

It is a plausible assumption that, having prepared and evaluated the necessary modules of instruction, the course instructor's job would be a lighter one. This has not proved to be the case. Although the instructor may be relieved of preparing and delivering a thrice-weekly lecture, other tasks demand his or her attention. Students still require direction

and animation and seek individualized attention in greater numbers than they would in an anonymous lecture course. In smaller classes of less than fifty, it is possible for the instructor to schedule conference and appointment times so that he or she can personally meet the requests of students without being overburdened or having to sacrifice research or service time.

Teaching assistants. For larger classes, however, it has been found that teaching assistants, usually graduate students in the area, are needed for conference, resource supplying, and evaluation tasks. Many modular courses employ teaching assistants who are stationed at a drop-in centre at specific times during the week. Students can drop-in to consult the teaching assistant when they have questions with greater convenience. According to Cave (1973), teaching assistants are crucial to the success of a modular course. The teaching assistants should be well versed in the content and administrative policies of the course, although their main responsibility is to lead conferences and to ensure that feedback on assignments and module tests is delivered in good time.

A frequent response in the evaluation of modular courses was, however, that teaching assistants were untrained and did not appear to know what they were doing or should do. Instructors using assistants have an additional administrative responsibility of instructing their assistants in the operation of the course and what their role is in it. Teaching assistants have been found to need competence in lecture, discussion, and questioning skills; in evaluation and feedback methods, in the course content, and in the

administrative policies of the course and the university, and should therefore be selected and trained with great care.

B. Administrative Procedures

Although one of the early priorities of the evaluation project was to improve the administration of modular courses, and although in the first year of evaluation (1972-73) administrative procedures caused most of the problems, this issue occurred least frequently (in only three courses) over the four years of evaluation. This is probably due to the fact that the university and modular instructors adapted administrative procedures suited to modular courses and thereby prevented such problems from arising after the first year.

A critical finding from the early evaluations was that greater advance planning and follow-through is required to manage a modular course. Prior to the start of the course, the instructor must ensure that all the arrangements have been made for the necessary resources such as handouts, audio-visual aids, guest speakers, laboratory equipment, drop-in centre supervision, and conference responsibilities, as well as the major one of training the teaching assistants. A primary problem with many newly developed modular courses at McGill was that materials were not ready on time resulting in course disorganization.

Because there are differences in administrative procedures in the course, students must be carefully advised of them. It is not sufficient to rely on what is going on in other courses, that is, the regular academic system, to act as a guide in a modular

course. In particular, students need to be informed about evaluation procedures, and about course and assignment requirements to allow them to proceed with their work. In general, the administrative procedures pertaining to the course should be clearly understood by the instructor, all teaching assistants, and the students.

Grading policy. This particular administrative procedure needs the special understanding of the department chairperson and the general university academic administration. Problems have occurred when three-quarters of a class operating on a mastery or contract plan have achieved an "A" grade. It has proved highly disconcerting to university administrators who expect that grades follow a normative pattern, with ten per cent "A's," twenty percent "B's," fifty percent "C's," and the remaining twenty per cent failures. The administrator's first fear is likely to be that academic standards have been lowered, but a more insidious threat is that such distributions of grades will render the university's grading system both suspect and incompatible with those of other universities. It is to be hoped that a mutually satisfactory grading policy will evolve not only in the university but among universities, a policy which awards credit for credible achievement.

C. Class Size

An often asked question is whether or not there is an optimal class size for modular courses. Teachers and students alike are concerned about whether there exists a maximum class

size beyond which the management system could not function. Lehman (1974) found little evidence to support the commonly held assumption that large classes are ineffective and that the quality of instruction is universally related to the student-teacher ratio for cognitive achievement in higher education. The trend in our findings has been, however, that the larger the enrollment in a class, the more likely it is that there will be administrative problems. One problem can be avoided by ensuring that a sufficient quantity of materials is available at the start of the course. If teaching assistants are well versed in administrative policies, they can help alleviate some of the problems and confusion that might arise. Very often, students in large modular courses complain that they never see a resource person, but courses can be organized so that students are informed at the beginning of the term who the teaching assistants are, and where and when they can be contacted.

The disorienting effect for some students of the different instructional pattern of modular instruction appeared to be augmented by larger class size. In classes as large as 400 and 1000, organizational and administrative problems were far more prevalent than they were in smaller classes. As an example, one course had only three teaching assistants and an instructor to cover the drop-in centre and grade the papers of more than 400 students. This lack of human resources resulted in cursory and inadequate monitoring of student projects, the loss of papers and grades, and a general feeling of harrassment and disorganization.

This general atmosphere predominated in another large course of 1,000 students in which module tests were administered to all class members at the same time. The only testing facilities large enough to handle such large numbers had inadequate lighting and spacing, which encouraged cheating and resulted in the loss. of many computer test cards.

It is often assumed by administrators that independent learning systems such as modular instruction require less human resources. These example refute any such presuppositions. Although instructors are no longer obliged to deliver regular lectures, the success of modular instruction often depends upon the availability of teaching staff to engage in higher level creative dialogue with students. An independent learning system then, does not imply that free reign be given to course expansion. Where numbers of students are necessarily high, as in the case of a basic course which is a prerequisite for others, care must be taken to ensure that sufficient human resources, such as teaching assistants, in a ratio of no more than 60:1, are supplied and that the course is organized in such a way as to encourage student involvement and optimize available resources.

D. Physical Facilities

Modular courses require space for audiovisual material storage and use, and for resources, both material and human, as well as study and conference areas. Most modular courses utilize some form of drop-in centre to provide students with an opportunity to get together to consult each other or to consult with the course

faculty and teaching assistants. The drop-in centre serves as a central point from which information concerning course enrichment and administrative policies is disseminated. Unfortunately, the atmosphere at the McGill drop-in centre was not conducive to learning because it was used as a lounge where students gathered to chat informally. The noise level and crowded atmosphere led students to avoid using it for study purposes unless they needed the help of a teaching assistant on duty there.

A private drop-in centre, located in the department or faculty and preferably not distant from the instructor's office, proved to be a considerable asset to the learning experience. In one modular course, part of the space allocated for the drop-in centre was used as a quiet study area and the other part was set-up as an informal meeting space with comfortable chairs. Because materials for the modules (such as module readings, tapes, and tape recorders) were kept in the drop-in centre and a teaching assistant was available to supervise the centre, the students using the drop-in centre had a resource person to consult.

University budgets may limit the granting of such a request, but in view of the difference in the effects of general or departmental drop-in centres, at this time we recommend that a modular instructor seek a room of his or her own or at least a space with a limit on the number of student users.

Organization of Modules

Where instruction is primarily dependent upon the learning materials, as in modular instruction, greater attention to the organization and effectiveness of the materials is essential. * More specific principles than chronology or discovery are needed to guide the module author in the assembly of learning materials. The most frequently occurring issue of all was that of direction: problems of direction occurred in forty-two per cent of the evaluations. The integration of learning and effectiveness of materials also occurred as issues in a large number of courses, making the organization of the modules themselves a critical area for investigation.

A. Direction

The need for adequate direction was a major concern in the evaluation of modularized instruction. This issue was particularly important where an entire course was modularized and students depended solely on packaged materials. It was found that courses which were only partly modular lacked sufficient direction as well. Many professors failed to realize that students need explicit directions as to what they must learn to meet the course requirements. Students felt that they were not provided with sufficient direction in terms of information or how much detail they were responsible for. This in turn led students to spend much time studying non-essential material which increased both their time spent and their resentment. Students often were

unclear about which audiovisual materials they were supposed to view and when. Closer coordination of readings and other materials was requested.

One major difference between modules and lectures is that in lectures students can extrapolate from the tone and pace of the lecturer what is most important. A lecturer tends to emphasize certain important information and will often tell students to take specific note of what is being talked about. This must be explicitly stated in modules.

To provide greater direction, four complementary and non-exclusive procedures are recommended and are discussed here in some detail. Each of these techniques has been used successfully in McGill modular courses.

Instructional objectives. A large selection of books and materials is available to aid the instructor in clarifying and specifying learning objectives or expected outcomes. Although this approach to providing learning direction has been more often used in professional schools or for skill development, learning objectives can equally well and readily be produced for highly abstract or higher order learning. Whether the subject matter is history or medicine, learning objectives provide a clear guide to what it is important to learn. The learning objective consists of three parts:

(1) the specific resources the student will use and the conditions under which he or she will learn;

(2) the expected outcomes from the learning; and

(3) the standard which the student will be expected to reach.

A sample learning objective would be: "Using module 6, part A 'Factors in Plato's Educational System' and reference readings in The Republic, pp. 66-102, the student will designate the educational pattern that would meet these requirements and fulfill the laws of Quebec education in a short paper of three to five pages, ensuring that each factor noted in the module is discussed." For a more detailed account of preparing instructional objectives, the following readings are suggested:

Geis, G. L. Why write and use behavioral objectives? Learning and Development, 1972, 3(1), 1-4.

Mager, R. F. Preparing Instructional Objectives. Belmont, California: Lear Siegler, Inc., 1962, pp. 60.

Vargas, J. Writing Worthwhile Behavioral Objectives. New York: Harper and Row, 1972, pp. 175.

Conceptual hierarchy. The most immediate way of organizing the subject matter in a course is to develop a statement or diagram which describes the structure of the course content and the relationships among concepts. Such an instructional overview should show students where they are going (the sequence of learning) and allow them to have advance knowledge of the information they are expected to synthesize. An example of this is shown in figure 2, which is a diagram showing the relationship of areas in a course on social service programs.

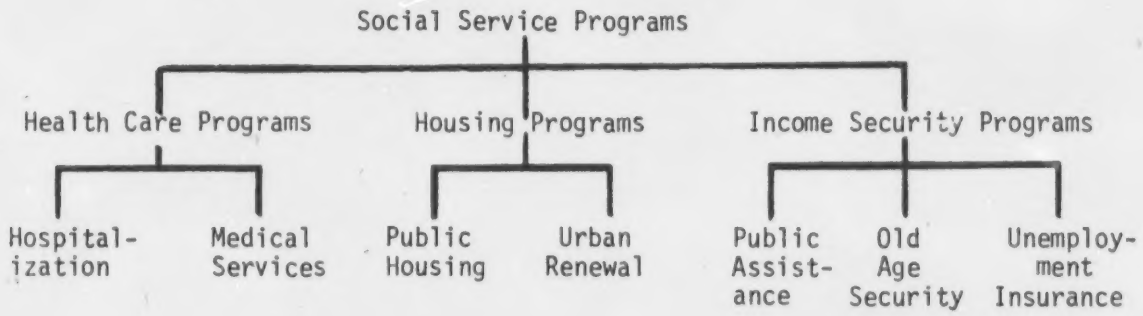

Figure 2. Organization of concepts in a social work course. (from Donald and Penney, Instructional Analysis Kit, 1976)

Advance organizers, that is, general concepts presented ahead of the material, aid students to link their learning and so integrate and retain it longer. In one modular course, students exhibited difficulty in handling and coping with the modules because they did not have a background of related concepts in the area. When organizers were introduced prior to the learning of the module, the comprehension scores of those given the advance organizers were significantly better than of those not given advance organizers. The advance organizers appeared to act as anchors so that integration of course material could occur (Donald, 1975).

Study guide. Direction can be provided in the module packages as an introductory page which describes the sequence of the modular process or as a section of the introductory course module. The delineation of one such process is described in figure 3.

In this course, the student follows a two-part assignment and evaluation procedure in each module. At each check-point, the student may be required to retrace certain steps in the learning sequence in order to reach mastery level.

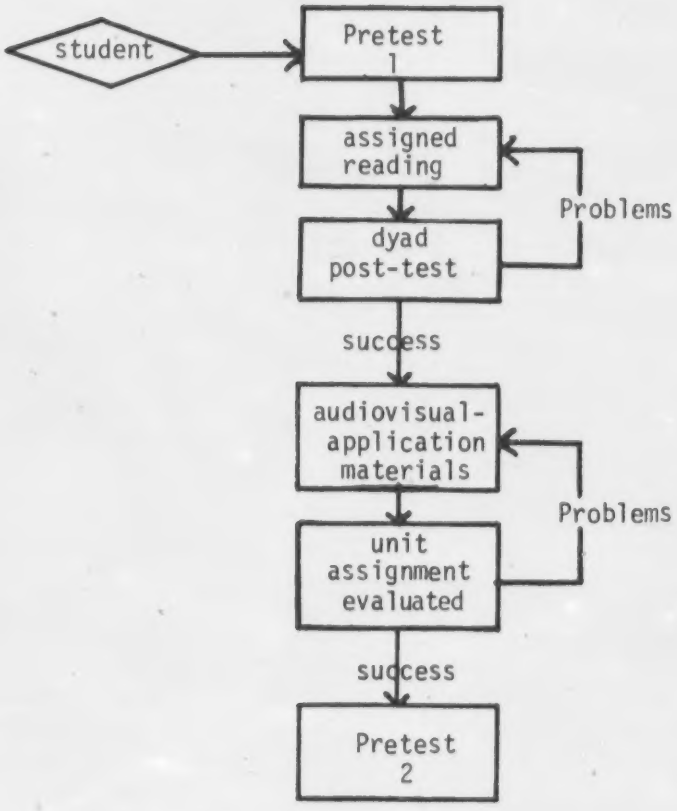

Figure 3. Sample modular course process

Suggestions for how to study and what to study are important parts of a study guide. Suggested time ranges for accomplishing each objective in the module would also prove useful.

Use of conferences. Conferences have been used successfully in courses where they have been regularly scheduled to give students direction in their learning. The person in charge of such a conference should be aware that he or she has the important function of describing the learning pathway and of keeping students on track.

In determining whether sufficient direction has been given in the modular course, the instructor should ask these questions:

1. Does each learning unit cover a discrete area and are the unit learning objectives clear?

2. Does the unit provide material and sufficient references to cover the entire area under question?

3. Does the unit take into account the entering level of the student and are remedial procedures and materials available?

4. Does each unit have a pre and post test corresponding to its objectives?

In electing one or more of these methods, the instructor may wish to consider the fit of the method to the subject matter, his or her own teaching style, and the background of students in the course. Field-testing different organization methods may prove necessary.

B. Integration

The integration of material in different instructional modules and of learning sources within a module posed a problem in ten of the courses evaluated. Since integration of the learning experiences is pivotal for long term retention, this aspect of modular instruction deserves close attention.

Among modules. One of the early problems in learning from modules arose because the modules in a course of study had been developed as independent learning units, often with different authors and in different styles. The result of using these units was that students, after a module post test, no longer referred to

the information in the module. At the end of a course, students found that they had acquired many bits and pieces without the glue to hold them together. They seemed to be emerging from their courses with no clear overview of the course or subject area. Without any demand for integration, course units could be forgotten while the course was going on, and long-term retention, which depends upon an integration of information, was threatened.

To aid integration, several methods were suggested and appear to have been successful in the courses in which they were applied.

1. The course conceptual heirarchy or instructional overview which also serves as a direction-giver can show how concepts in the course and different parts of the course are connected.

2. The modules may be related to one another by means of a core or introductory module, mini- or linking modules which may take the form of overviews, cumulative reviews, or cumulative tests or assignments, or special lectures or seminars.

3. The demand to integrate may be placed on the student by means of a course project or study which requires integration of material, the use of instructional objectives which require the integration of material from different modules, or course comprehensive examinations which demand complete coverage of the course material.

Within a module. Emphasis on integration within the learning unit has also attracted attention. In the evaluation of modular courses, the problem of a lack of integration was

particularly manifest in those modular courses which included formal lectures as part of the requirements of the course. Such courses were often found to have a lack of integration between the material in the module booklets and that dealt with in the lectures. Students often mentioned that they found modules helpful but unrelated to lecture topics and assignments. Another problem arose where modules consisted of a compilation of readings from various sources without a synthesis of the materials included. In some courses, audiovisual material prepared from outside sources did not match the course material and so created a learning dissonance.

In order that the arrangement of the different components of the course (modules, lectures, seminars) be effective, the individual components must reinforce one another; and jointly they must serve to ensure that the general goals of the course are met (Cave, 1973). The clear relationship of components and subject matter is critical to the overall effectiveness of the course.

The possible solutions to problems of within-module integration follow the same pattern as those for greater integration among modules. Many of the links or fallen bridges within a module, however, can be discovered early by field-testing the materials on a small sample. Testing for a "match," a "fit," or a "connection" will ensure a measure of integration within a module. Having unit objectives, projects, and evaluation methods require students to integrate concepts learned in the units should lead to a greater integration of learning.

C. Effectiveness of Materials

This third most frequently voiced issue occurred in sixteen course evaluations. Two kinds of measurements of the efffectiveness of materials can be made. The first is student achievement in the course and the second is student satisfaction. Two trends were noted in courses using modular instruction, although the variability among courses could only lead one to conclude that it was due not to the modular instruction method but to the organization of the particular course. First, in some modular courses, grades were much higher than previously: this was due primarily to a mastery method of learning and grading. Where the course * was well organized and met most of the requirements for good modular instruction, including in particular a fair degree of course structure and contact, grades were noted to be generally higher. Students reported that they had worked harder and had spent more time on the course as well.

The second trend operated in a negative direction: where courses were loosely organized and class size was larger, there * tended to be a greater number of students dropping out or not completing the course requirements. It could be inferred that a lack of course structure led to decreased motivation on the part of students.

Student satisfaction was highest generally where the course had a medium-sized population, approximately 40 to 60 students, and was well organized. Student dissatisfaction was voiced when module text and assigned readings contradicted each other and the contradiction was not resolved, when module booklets contained

too much detail and irrelevant facts or when they were sketchy or vague and needed clarification and elaboration. Audiovisual material was found unsatisfactory when poorly or woodenly narrated or when taped material was presented without any adjunct written material.

Individualization. During the evaluation of modular courses, we questioned the effectiveness of modular materials for different students. One of the stated aims of modular instruction was to provide for the individualization of learning, that is, to tailor the learning experience to the individual student's learning style. Knowing that study skills can be as important as student ability in achievement using individualized instruction, and that personality variables such as independence and will power also affect success, we have presented a position more in the direction of compensating for a lack of preferred skills. We do not deny, however, the importance of the long-term objective of providing students with the opportunity to develop their own learning system for life-long education. To provide not only different modes of instruction, visual or oral, group or individual, but also to respond to students' differing needs for feedback, guidelines, and structure present a major challenge to the module developer. Alternative but equal paths of learning which take into account essential course material and maintain the same high standard of learning will hopefully improve learning for the individual student.

CONCLUSIONS AND RECOMMENDATIONS

This section is intended as a summary of the conclusions and recommendations that we were led to make over the course of four years of evaluating modular instruction. They are catalogued according to the issues in response to which they developed.

Course Structure

1. Because success in modular courses relies more heavily on study skills than in conventional courses, the provision of study skills or guidelines is a necessary adjunct to a modular course.

Course Requirements

2. Modules should be weighted as to difficulty, and a policy of equal work for equal grades across modules should be instituted.

3. Options to fit varying student background allow a modular course to meet individual student needs.

4. Course requirements should be clearly and fairly stated, and should be responsive to student background.

Availability of Materials

5. One of the purposes of developing modules is to provide the student with the necessary learning material in one unit so that it is readily available.

6. Planning for a modular course should take into account the large amount of time required to develop modules so that sufficient lead time is allowed.

7. Students require an introduction to instructional materials and equipment.

Contact

8. Students need a continued contact of some kind with their instructor. The instructor may wish to canvas students to determine the kind of contact preferred.

Pacing

9. Some pacing guidelines are needed to provide limits for students within the course requirements.

10. Providing students with self-study skills will enable them to develop their own limits or pacing system.

Student Workload

11. Students need to know what is essential material in the modules; content overviews, pretests, and instructional objectives can be used to overcome this problem.

12. To determine the length and difficulty of modules, they should be given a developmental field test on a small group of students.

Alternative Presentation of Material

13. Students prefer to have their own copies of reading material, available at the time needed.

14. Audiovisual materials must be essential, well coordinated, and easily reached for ready use by students.

15. Conferences should be devoted to the promotion of discussion among students rather than to a review of the material.

16. Supplementary or enrichment lectures serve to provide the students with direction in the course, clarify the material presented in the modules, and integrate information from the various sources used.

Evaluation of Learning

17. Students in modular courses have a special need for prompt feedback on their work.

18. Evaluation should reflect course objectives and students should be informed about what they are responsible for.

19. Modular instruction provides the instructor with an opportunity to use a mastery learning system of evaluation in which students are required to display a high level of competence in any unit.

Management

20. Because department administrative procedures will require adaptation to modular courses, obtaining the early support and assistance of department heads is suggested.

Amount of Assistance Required

21. Teaching assistants have been found to need competence in lecture, discussion, and questioning skills, in evaluation and feedback methods, in the course content, and in the administrative policies of the course and the university, and should therefore be selected and trained with great care.

Administrative Procedures

22. Greater advance planning and follow-through is required when one begins to manage a modular course.

23. Because administrative procedures in a modular course differ from conventional procedures, students must be carefully advised of them.

Class Size

24. In a large course, care must be taken to ensure that sufficient human resources are supplied and that the course is organized in such a way as to encourage student involvement and optimize available resources.

Physical Facilities

25. A drop-in centre located not distant from the instructor's office proved to be a considerable asset to the learning experience.

Organization of Modules

26. The assembly of learning materials into modules required adherence to a set of principles of organization.

Direction

27. Direction can be provided to students in the modules by means of instructional objectives, a conceptual hierarchy, or a study guide, or through the use of conferences.

Integration

28. Learning from modules can be integrated through the use of an instructional overview, by a core or introductory module which

links different modules, by cumulative tests, assignments, or projects, or by means of special lectures or seminars.

29. The individual components of a module should be developed and field-tested so that they reinforce each other.

Effectiveness of Materials

30. Where the course was well organized and met most of the requirements for good modular instruction, including in particular a fair degree of course structure and contact, grades were noted to be generally higher.

31. Where courses were loosely organized and class size was larger, there tended to be a greater number of students dropping out or not completing the course requirements.

32. Alternative but equal paths of learning which take into account essential course material and at the same time maintain a high standard of learning should improve the educational process for the individual student.

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APPENDIX A

Modular Courses Evaluated At McGill

Professor	Department	Course
Bellert, I. A. Gopnik, I.	English	English 233A, 234B, 238B
Butler, I.	Chemistry	Modern Inorganic Chemistry I 180-201A,B
Campbell, J.	Psychology	General Experimental Psychology 204-210D
Chan, T. H. Harrod, J. F.	Chemistry	Integrated Inorganic/Organic Laboratory 180-392B, Synthetic Organic Chemistry 180-372A,B
Drummond, N.	Geography	Introduction to Cartography Air Photo Interpretation 183-201A
Duder, S.	Social Work	Introduction to Social Work Research 407-270A
Earle, R	English Education (Reading Centre)	Reading Instruction: High School 427-523
	English Education (Reading Centre)	Supervision of the Teaching of Reading 427-669
Fenichel, A. Naylor, R. T. Davenport, P.	Economics	Introductory Economics 200D
Fenichel, A. Naylor, R. T.	Economics	Economic Analysis and Applications 154-200D
Floch, W.	Education	Special Education 340A,B
Frojmovic, M.	Biology	Cell and Molecular Biology 177-210D
Gopnik, I. Gopnik, M.	Linguistics	Introduction to the Study of Language 200A,B
Heukel, H. J.	Chemistry (Macdonald)	Chemistry 232A
Hill, S.	Entomology	General Entomology 350-330A

Professor	Department	Course
Japp, R. Selby, D.	Civil Engineering	Mechanics I 200-005A,B
Jones, R.	Education	Educational Media 432-204
Kiriakos, R. Z.	Psychiatry	Med. III - Programme in Psychiatry
Lafon, M.	English	Canadian Literature 110-228A
Mackenzie, A. F.	Renewable Resources	Soil Science 372-210A
Massam, B. M.	Urban Planning	Applied Quantitative Methods
Onyszchuk, M	Chemistry	Chemistry of the Main Group Elements 180-281A,B
Perron, P.	Music	A Modular Course in Ear Training 212-130A
Robinson, G.	Sociology	Canadian Mass Communication 217A
Runnalls, D.	Religious Studies	Methods of Biblical Criticism 303D and 310D
Ruvinsky, M.	English	Modular Introduction to Film 338D
Shultz, T.	Psychology	Advanced Child Psychology
Southin, J.	Biology	Collaborative Studies in Science and Human Affairs
Stein, J. Butler, P.	Political Science	Foreign Policy in the Third World 247B
Thomas, D.	Physical and Occupational Therapy	Treatment Procedures Physical Therapy V 581-215B
Vicas, A. F.	Economics	History of Economic Thought 350D
Woloch, G. M. Snyder, G. L.	Classics	Greek Civilization 200D

APPENDIX B

Issues in Innovative Instruction

I Course Structure

Because innovative instruction entails a variety of course structures different from traditional instruction, the accepted rules of learning in higher education such as term papers and examinations being the course requirements; attendance at class being considered equivalent to "taking a course"; and normative grading practices are called into question. The most obvious effect of changing the course structure is the question which arises around the amount of freedom or control of the learning activities. In some courses, students have been given a more precise idea of the learning expectations of the instructor. In others, students have been given increased responsibility for their learning, often without suggested guidelines of how to approach their studies. Our task is then to determine the range of structures and approaches and their effects in the following areas.

A. Course requirements

1. What part of the course is mandatory, and what part optional?
2. What is the variety of options available, in content and the fulfillment of requirements?
3. To what extent are the learning experiences and the required skills set out clearly?
4. Does the way in which learning is evaluated ensure that students reach a minimum level of performance?

B. Availability of materials

1. Are all learning materials available to students in sufficient number and when needed?
2. If students must share materials, has a fair and reasonable management system been instituted?
3. Is the cost of learning materials reasonable?

C. Contact

1. Has there been sufficient opportunity provided for students to contact the instructor or teaching assistant?
2. Do students appear to need greater contact with other students?
3. Does motivation to learn depend on the amount of contact?

D. Pacing

1. In what ways do students control their own work rate?
2. Do students actually pace themselves differently in this course than they would in a lecture-discussion course?
3. What proportion of students need deadlines and/or penalities in order to complete their work?
4. Can the university or college and its faculty afford to allow students to be self-pacing in their work?

E. Workload

1. Is the amount of work done by a student in an innovative course greater than, the same, or less than the work done in a conventional course?

2. In what ways is the kind of work done different in an innovative course?

F. Alternative presentation of material

1. Where different modes of presentation are used in a course, in what way to they relate e.g. lectures with learning units?
2. What is the value and utility of alternative modes of presentation of material?

G. Evaluation of learning

1. Do evaluation procedures reflect course objectives?
2. Are students informed as to what they are responsible for?
3. Is evaluation of student learning provided sufficiently frequently and when needed?

II Management System

Innovative instruction demands a different management system from that normally employed in the university or college. To the extent that a course is individualized, different records and evaluation practices must be used. Students working with a variety of materials and dealing with units of instruction rather than a "course" require different administrative procedures.

A. Amount of assistance required

1. How well were innovative courses organized so that student energy was spent learning?
2. Were a sufficient number of teaching assistants or monitors available to assist students in their work where required?
3. Was feedback on assignments or unit tests delivered in good time?
4. Were teaching staff available for the purpose of creative dialogue?

B. Administrative procedures

1. Was there conflict between management of the innovative course and department or institution practices?
2. How did grading policies compare?
3. Were innovative courses more or less demanding of the professors' time?

C. Class size

1. Was there an optimal class size for innovative courses?
2. Was there a maximum class size beyond which the management system could not function?
3. What kinds of management systems could be used with classes of different sizes?

D. Physical facilities

1. What are the space requirements in the university for innovative instruction?
2. Was the atmosphere in the drop-in centre conducive to learning?

III Organization of Learning Units

A specific consequence of providing instruction in units is the attention focused on the organization of the learning materials. More justification than chronology or discovery is then required in the teaching-learning process.

A. Direction

1. Does each learning unit cover a discrete area of questions or do units overlap?
2. Does the unit provide material and sufficient references to cover the entire area under question?
3. Does the unit take into account the entering level of the student?
4. Are remedial units available?
5. Are unit objectives clear?
6. Does each unit have a pre- and post-test corresponding to its objectives?

B. Integration

1. Within the course structure, are attempts made to integrate learning from different units?
2. Is an overview of concepts and their connection given in the course?
3. Do unit objectives, projects, or evaluation methods require students to integrate concepts learned in the units?

C. Effectiveness of materials

1. Does the organization of materials lead to optimal learning conditions?
2. Are students provided with an outline for the course organization?
3. Are goals, objectives, and conceptual themes clearly presented?
4. Are sufficient examples of concepts provided?
5. Are assignments and applications meaningfully related to the theory and concepts in the units?

Janet Donald

1 April 1976

APPENDIX C

Modular Instruction: what it is and how you use it

A module is a self-contained, independent unit of a planned series of learning activities designed to help the student accomplish certain well-defined objectives.

Using modules, you will find that you are more responsible for your own learning than in conventional courses. You may determine your own rate of progress; you may skip material already familiar to you; and you may repeat sections which you find difficult.

BUT

1. You must plan. To learn, you must set aside enough time to work on the modules on a regular basis. In these modules, the activities will take up most of the available class time. Pretests, post tests, audiovisual material, and additional study time should be planned for outside class time.

2. You must pace yourself. Only you can judge the most efficient use of your time. The best way of pacing is to set your own deadlines, both for learning the material and for your own project.

3. Ask. Consider your instructors as resources, available for advice and for helping you over difficult spots. Independence does not mean loss of contact.